C. L. BOISSET.

VARIABLE STROKE HYDRAULIC PUMP.

APPLICATION FILED FEB. 10, 1921.

1,418,616. **Patented June 6, 1922.**

3 SHEETS—SHEET 1.

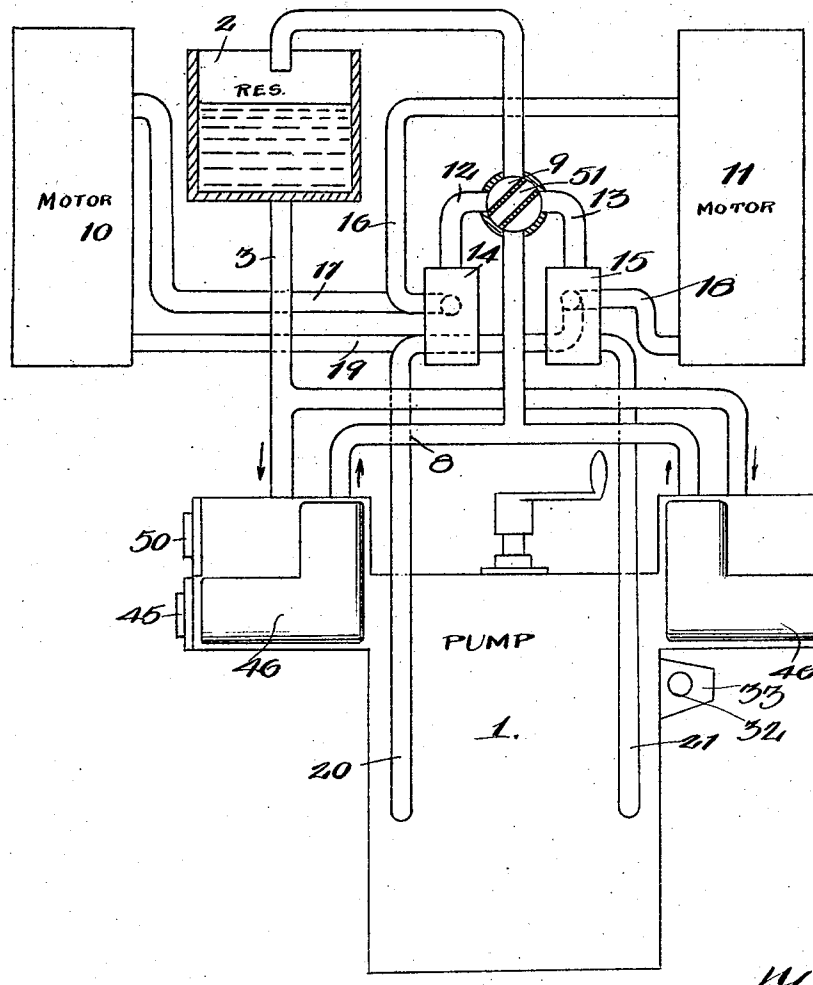


Fig. 1.

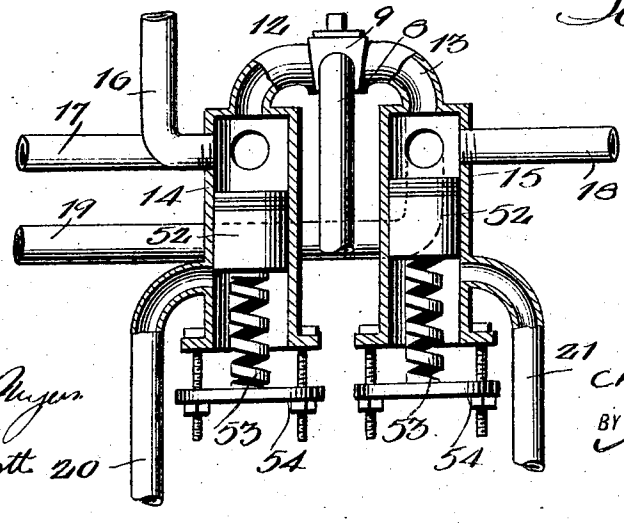


Fig. 2.

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3 SHEETS—SHEET 2.

Fig. 3.

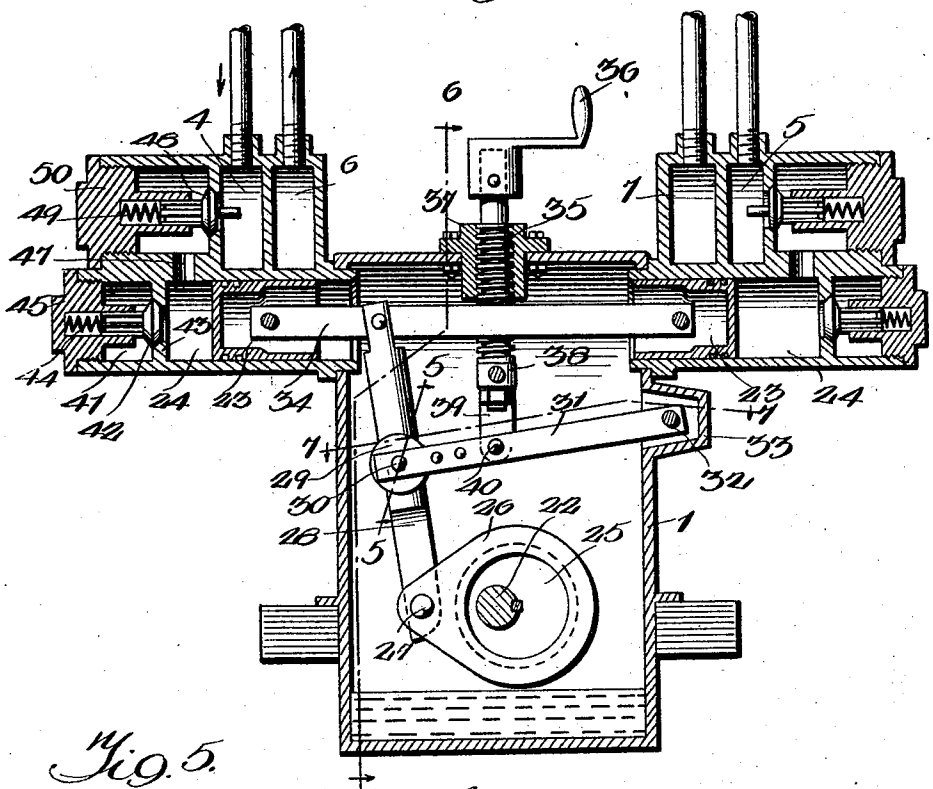


Fig. 5.

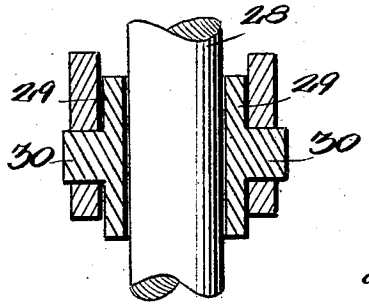
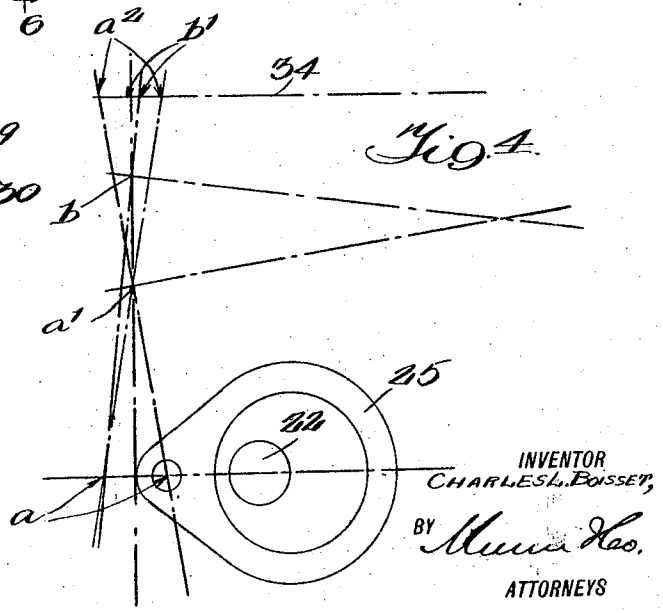


Fig. 4.



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3 SHEETS—SHEET 3.

Fig. 6.

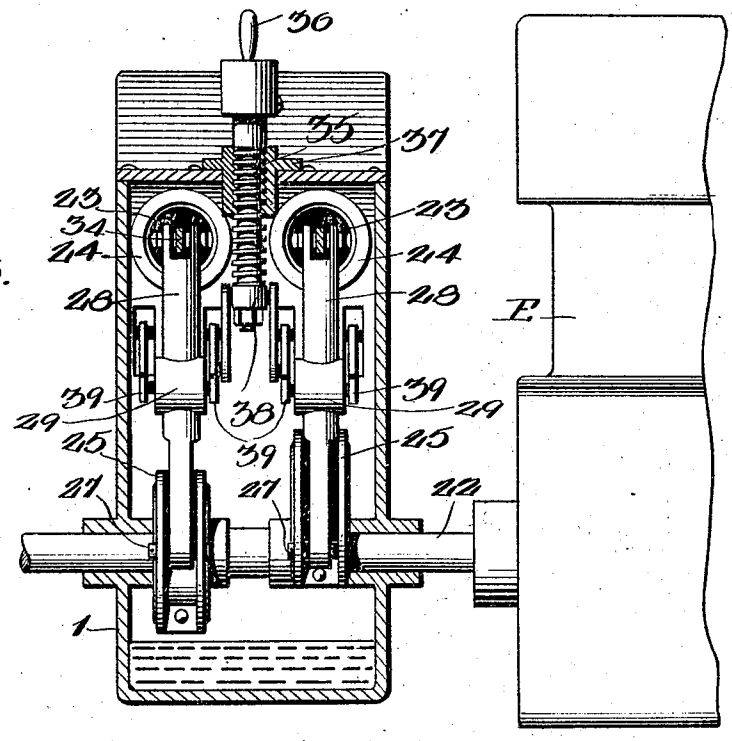


Fig. 7.

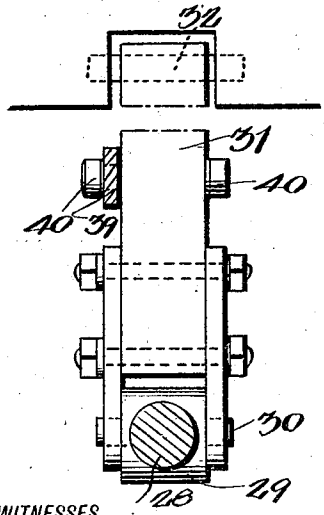
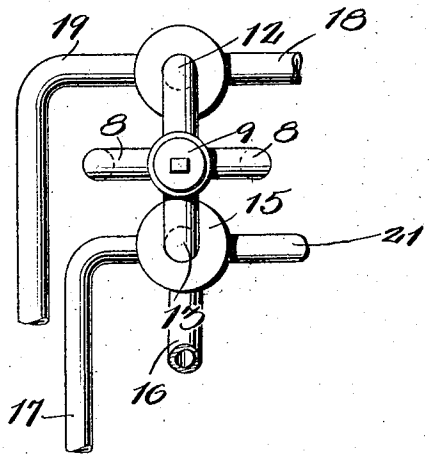


Fig. 8.



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UNITED STATES PATENT OFFICE.

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VARIABLE-STROKE HYDRAULIC PUMP.

1,418,616. Specification of Letters Patent. Patented June 6, 1922.

Application filed February 10, 1921. Serial No. 444,026.

To all whom it may concern:

Be it known that I, CHARLES LEON BOISSET, a citizen of the Republic of France, residing at New Orleans, in the parish of Orleans and State of Louisiana, have invented certain new and useful Improvements in Variable-Stroke Hydraulic Pumps, of which the following is a specification.

My invention relates to improvements in hydraulic pumps, it being more particularly an improvement on the pump disclosed in my co-pending application for Letters Patent filed June 5, 1920, Serial No. 386,764, and it consists in the constructions, combinations and mode of operation herein described and claimed.

One of the foremost objects of the invention is to provide a uniformly driven variable stroke pump of a very simple construction, enabling obtaining any motor speed between predetermined limits.

A further object of the invention is to provide means in this pump, for varying the piston stroke without shock or jar, thereby enabling an easy progression from one speed to another throughout the range of speeds which the pump is capable of producing in the operatively associated motor.

A further object of the invention is to provide in combination with the pump, a pressure relief device or shock absorber, the specific function of which is to make the fluid outlet valves close promptly instead of lagging behind.

Other objects and advantages will appear in the following specification, reference being had to the accompanying drawings, in which:

Figure 1 is a diagram illustrating the general relationship of the improved pump with a hydraulic transmission system,

Figure 2 is a detail sectional view of the shock absorber which functions in connection with the pump to close the fluid outlet valves,

Figure 3 is a longitudinal section of the hydraulic pump, corresponding to the position shown in Figure 1,

Figure 4 is a diagram showing how the adjustable fulcrum may vary the piston stroke,

Figure 5 is a detail section on the line 5—5 of Figure 3,

Figure 6 is a cross section taken substantially on the line 6—6 of Figure 3,

Figure 7 is a horizontal section taken substantially on the line 7—7 of Figure 3, and

Figure 8 is a detail plan view of the shock absorber illustrated in Figure 2.

In order to show in what connection the improved hydraulic pump 1 is used, attention is directed to Figure 1 wherein a hydraulic transmission system is illustrated. This system may be like that disclosed in my co-pending application filed June 5, 1920, Serial No. 386,764, or in my more recent co-pending application for Letters Patent on steering apparatus for tractors, filed Feb. 10, 1921, Serial No. 444,027. There is a fluid reservoir 2 from the bottom of which the pipe 3 leads to the inlet chambers 4 and 5.

The outlet chambers 6 and 7 of the pump have a pipe connection 8 discharging into the reservoir but embracing the four-way valve 9, by means of which the direction of operation of the hydraulic motors 10 and 11 is controlled. Connected to the valve 9 at points 90° from the parts of the pipe 8, are pipes 12 and 13 leading to the cylinders 14 and 15 of the shock absorber in Figure 2. The pipes 12 and 13 have continuations 16 and 17 to one side of each motor and 18 and 19 to the other sides of these motors. Relief pipes 20 and 21 communicate between the cylinders 14 and 15 and the casing of the pump.

This gives a general outline of the hydraulic system and attention is now more particularly directed to the pump structure shown for example in Figure 3. In the casing 1 there is journalled the eccentric shaft 22 which is also the engine shaft inasmuch as it extends off into the engine E generally designated in Figure 6. The engine is driven at an approximately uniform speed, but the strokes of the pistons 23 in the opposed pump cylinders 24, are variable so as to in turn vary the speed of the hydraulic motors 10 and 11 in accordance with the volume of fluid delivered thereto.

A plurality of eccentrics 25 are keyed to the eccentric shaft. In the present instance there are shown two sets of cylinders, and consequently only two eccentrics. The pump may consist of more than four cylinders, the actual number depending on the nature of the work in connection with which it is intended to be used. The eccentrics 25 are approximately 90° apart.

On each there is a strap 26, pivoted at 27 to a rocker bar 28 which is made round

throughout its upper part to readily enable sliding of the fulcrum 29. This fulcrum is made of a short section of round rod. That is why it appears circular in the end view in Figure 3. A hole is bored into this short section to accommodate the rocker bar 28. There are trunnions 30 at each end to provide pivotal mountings for the side parts of the radius link 31.

This link in turn is pivoted at 32 in an extension housing 33. The upper end of the rocker bar is pivoted to the connecting rod 34 which joins two pistons. The link 31 is raised and lowered by turning the screw 35 through the crank 36. The screw works in a bushing 37, and at the lower end it carries a yoke 38 with depending straps 39 having pivotal connections 40 with the link 31.

Consider Figure 4. The stroke a of the eccentric 25 is always the same. When the fulcrum 29 is moved to its lowermost position a', the stroke a^2 of the connecting rod 34 is approximately the same as that of the eccentric. Should it be desired to diminish the output of the pump, the fulcrum is moved up anywhere between the extremities of position it is intended to occupy, until the upper extremity b is reached.

Now the stroke b' of the connecting rod 34 is greatly diminished, but the stroke of the eccentric remains the same as before. It is simply a question of shifting the fulcrum up or down, thereby changing the stroke of the pump according to the changes in leverage in the rocker bar 28. It may be emphasized that the speed of the engine and stroke of the eccentric remain the same, but the stroke of the pump or the pistons therein is variable and consequently the speed of operation of the motors 10 and 11 is variable.

At the head of each piston there is an outlet chamber 41 which is common to all of the outlet valves (at present two on each side) 42. These are seated in the partition 43 by springs 44 in the caps 45 which support and guide the valve stems. A port 46, cast on the outside of the cylinder 24, communicates with the outlet chamber 6. A port 47 provides communication between the cylinder 24 and the valve chamber immediately above.

There is one of these chambers above both cylinders, and the chambers contain the inlet valves 48, also pressed to their seats by springs 49 in caps 50 which additionally serve to guide the valve seats. The construction on each side of the pump is the same, and the foregoing description of one side suffices for both. The pump is double acting by virtue of having the cylinders and pistons in tandem.

The operation may now be reviewed to advantage, in so far as the pump is concerned. It has already been made clear in connection with Figure 4, that when the fulcrum 29 is moved down to the point a', the full stroke of the eccentric 25 is imparted to the pistons. Consequently, the motors 10 and 11 operate at maximum speed, due to the maximum volume of fluid delivered.

When the fulcrum is adjusted high there is a diminution in the volume of fluid delivered past the outlet valves 42, naturally by reason of the reduced piston strokes, and consequently the motors operate that much slower. It only remains to be stated that reversal of the motors is obtained by turning the valve 9 to a position 90° away from that shown in Figure 1, and when the valve plug is turned into a central position so that the port 51 brings the adjacent parts of the pipe 8 into communication, there is simply a circulation between the pump and reservoir, and no driving of the motors results.

The shock absorber in Figure 2, is indispensable in that it is through its instrumentalities the outlet valves 42 are closed promptly, thereby contributing immeasurably to the efficient operation of the pump. Each cylinder 14, 15 has a piston 52 pressed inwardly by a spring 53 adjustable in tension either by the means 54 or other equivalent means.

Below the head of each piston there is the outlet to the relief pipes 20, 21, which lead to the pump casing or some other convenient point. As fluid is discharged by the pump it enters one or the other of the cylinders 14 and 15 either by way of the pipe 12 or 13, depending on the position of the valve 9. There is therefore a pressure against one of the pistons 52. But this pressure is opposed by the springs behind.

Now this spring pressure makes itself evident on the fluid column in front of the piston at that instant when the valve 42 starts to close on the recession of the pump piston 23, at that time causing a quick and positive closure of the valve and preventing any oil from getting back into the cylinder 24, which it might do if there be any lagging in the operation of the outlet valve.

A further purpose of the shock absorber is to provide a relief for the hydraulic system should the pressure in the conduits for any reason become excessive. In such event, the piston 52 on one or the other side, will recede until the outlet to one or the other of the relief pipes 20, 21 is uncovered. Fluid will flow back to the pump casing until an equilibrium is reached, when the pistons 52 will be restored to normal. Besides functioning to close the outlet valves, the shock absorber imparts a certain elasticity to the fluid which transmits the power from the pumps to the motors, this by reason of the spring-pressed pistons which produce a counter pressure.

While the construction and arrangement of the improved variable stroke hydraulic pump as herein described and claimed, is that of a generally preferred form, obviously modifications and changes may be made without departing from the spirit of the invention or the scope of the claims.

I claim:—

1. In a pump, a connecting rod between pistons in two cylinders; a uniformly driven engine shaft with an eccentric and strap, a rocker bar pivoted between the connecting rod and strap, a fulcrum slidable on the bar, comprising a piece with trunnions; a radius link pivoted to the piece at the trunnions, and a screw shaft with a swivel yoke having strap connection to the link.

2. A pump, comprising a cylinder with valved inlet and outlet chambers leading to fluid conduits, means in the outlet conduit producing counter pressure to cause the outlet valve to close promptly, including a cylinder with a spring-pressed piston; a pump piston with a connecting rod, a uniformly driven shaft, with an eccentric and rocker bar connection to said rod, and a fulcrum for the rocker bar, with means for raising and lowering it to change the pump stroke from that of the eccentric.

CHARLES LEON BOISSET.